

### Claims

1. A method for processing a multi-user signal, the method comprising an iterative receiver process including the steps of:
  - (a) receiving a signal transmission including a plurality of user signals on a TDMA channel;
  - (b) detecting one or more user signals and determining transmission channel estimates for each said user signal;
  - (c) deriving a soft signal for a first user by subtracting, if available, weighted representations of other user signals from the detected user signal of said first user;
  - (d) calculating a-posteriori probabilities for each symbol comprising the soft signal;
  - (e) refining said probabilities utilising the transmission channel estimate for the first user in an iterative decoding algorithm, wherein a probability is either partially or fully decoded depending on the application of decoder convergence criteria; and
  - (f) returning to step (a), (b) or (c) with the refined probabilities forming part of the weighted representations to be subtracted from detected user signals of other users.
2. The method of claim 1, further comprising the step of either continuing further steps or producing a hard signal for the first user and discontinuing further steps depending on the application of receiver convergence criteria to the decoded probabilities.
3. The method of claim 1 or claim 2, wherein during the first iteration of the iterative receiver process, the decoder convergence criteria includes comparing the interference on the detected user signal for the first user with an interference threshold determined by estimating the noise equivalence of interference on the detected user signal due to other user signals, with the probabilities being fully decoded if the interference is below the interference threshold or partially decoded if the interference is above the interference threshold.
4. The method of any one of claims 1 to 3, wherein the decoder convergence criteria includes adaptively adjusting a threshold of a stopping criteria, a probability being fully decoded when the application of the stopping criteria to a probability results in a value less

a detector for detecting one or more user signals and determining transmission channel estimates for each said user signal;

an interference canceller for deriving a soft signal for a first user by subtracting, if available, weighted representations of other user signals from the detected user signal of said first user;

means for calculating a-posteriori probabilities for each symbol comprising the soft signal;

a digital signal processor for running an iterative decoding algorithm to refine the probabilities by utilising the transmission channel estimate for the first user, wherein a probability is either partially or fully decoded depending on the application of decoder convergence criteria; and

means for inputting the refined probabilities to the interference canceller to form part of the weighted representations to be subtracted from detected user signals of other users.

15. The receiver of claim 14, further comprising means for producing a hard signal for the first user and discontinuing the iterative receiver process depending on the application of receiver convergence criteria to the decoded probabilities.

16. The receiver of claim 14 or claim 15, wherein during the first iteration of the iterative receiver process, the decoder convergence criteria includes comparing the interference on the detected user signal for the first user with an interference threshold determined by estimating the noise equivalence of interference on the detected user signal due to other user signals, with the probabilities being fully decoded if the interference is below the interference threshold or partially decoded if the interference is above the interference threshold.

17. The receiver of any one of claims 14 to 16, wherein the decoder convergence criteria includes adaptively adjusting a threshold of a stopping criteria, a probability being fully decoded when the application of the stopping criteria to a probability results in a value less than the threshold and partially decoded when the application of the stopping criteria results in a value greater than the threshold.

18. The receiver of claim 17, wherein the stopping criteria utilise the refined probabilities from a previous iteration of the iterative decoding algorithm.

19. The receiver of claim 17 or claim 18, wherein the stopping criteria comprises a sign change ratio stopping criteria.
20. The receiver of any one of claims 14 to 16, wherein the decoder convergence criteria utilises a stored value of the optimal number of iterations of the iterative decoding algorithm for any particular iteration of the iterative receiver process.
21. The receiver of claim 20, wherein the stored values are calculated from investigation of the convergence behaviour of the iterative decoding algorithm and/or the iterative receiver process.
22. The receiver of claim 21 wherein the investigation includes analysing the exchange of mutual information between the output of the interference canceller and the iterative decoding algorithm during an offline simulation of the iterative receiver process.
23. The receiver of any one of claims 14 to 22, including a plurality of calculating means and digital signal processors for the parallel refining and decoding of a posteriori probabilities for each of the plurality of users detected by the detector.
24. The receiver of claim 23, including a channel estimator for providing updated channel estimates for each user and combining the updated channel estimates with the refined probabilities to form the weighted representations of user signals used in a subsequent iteration of the iterative receiver process.
25. The receiver of claim 24, wherein the updated channel estimates for each user signal comprise an estimate of characteristics selected from the group of timing, interference, frequency, amplitude, phase and interference.
26. The receiver of any one of claims 14 to 25, wherein the iterative decoding algorithm is a turbo decoding algorithm.